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ABSTRACT

An overview of current theories of reading and the acquisition of literacy skills by children is presented. A research framework in which reading can be described in terms of the processes employed in other language uses is introduced and used to explain the failure of some children to learn to read. An ongoing research program is described that examines the way in which underlying skill components, analysis of linguistic knowledge, and control of linguistic processing are involved in reading. Future research directions are indicated. It is suggested that what is needed is a linguistic theory that will set the framework for the types of processes that the researchers have observed and empirically demonstrated with children learning to read. Contains 22 references. (Author/LB)

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Learning to Read: Process and Problems in Acquisition

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An overview of current theories of reading and the acquisition of literacy skills by children is presented. A framework in which reading can be described in terms of the processes used in other language uses is introduced and used to explain the failure of some children to learn to read. Future research directions are indicated.

Thorndike, in 1917, described reading in the following way:

> The mind is assailed as it were by every word in the paragraph. It must select, repress, soften, emphasize, correlate and organize, all under the influence of the right mental set or purpose or demand.

Huey, in 1908, remarked that to understand reading would entail descriptions of some of "the most intricate workings of the human mind".

How adults cope with such cognitive demands is mystery enough, but how children manage to conquer the problem is practically extraordinary. Learning to read involves every part of the child's mental abilities - language, computation, knowledge of the world. So how do children learn to read? What role does their knowledge of language play in this task? And why do some children fail to master this skill, at least to the level of their otherwise-similar peers?

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Models of reading which address these problems have gone through many stages, and I will only briefly summarize them here. Not surprisingly, theories of reading at different times have reflected current psychological perspectives, and pedagogical approaches have similarly been tailored to fit these conceptions. Accordingly, during the reign of behaviourism, reading was considered to be a matter of pattern recognition, and phonics instruction was sacrificed to the world of "look-say" or whole word methods. This view of instruction was later buttressed by the claim of Ken Goodman (1967) and others that reading was a "psycholinguistic guessing game". On that view, readers proceed by guessing subsequent words on the basis of context before encountering the actual words in the text. Minimal visual information about word shapes and the like is used simply to confirm or disconfirm those guesses. Here, too, the best instruction could hope to achieve would be to aid word recognition processes.

More cognitively-inspired views of language acknowledged that language must be processed, not simply recognized. On this view, reading was a matter of "assembling" language out of the written text, and the relevant tool was "decoding". In psychological jargon, these were the "bottom-up views" popular in the late 1960's and early 1970's by researchers such as LaBerge and Samuels (1974). Hence, instruction involved teaching children the basic skills of phonetic segmentation, decoding, and blending. This approach, in fact, was the basis of large-scale

intervention programmes in the late 1960's aimed at helping socially disadvantaged children who had traditionally experienced massive school failure, programmes such as Project Head Start in the United States.

While there is little psychologists agree about today concerning reading, and few coherent "truths" that have been offered, it is certainly acknowledged that reading is more complex than any of these earlier restricted views allowed. Indeed, most models of reading are now more properly described as "interactive": word recognition, context, and phonetic decoding all play an integral role. Consequently, instructional methods have diversified and are generally more eclectic than were the methodologies based on earlier views. Notable exceptions to this are reading programmes which have developed for specific purposes, either in terms of teaching reading or intervention in reading difficulties. In these special cases, instruction is strongly determined by the underlying theory and carefully monitored for its compliance with those tenets.

Interactive Models of Reading

What, then, is the present view of reading? How do children learn to read? To begin, then, let us examine some of the common features of the current interactive models, without dwelling on the specifications of any particular one. First, interactive models of reading are generally based on information-processing systems consisting of several knowledge sources. These knowledge sources typically include components for different levels of

linguistic representation, for example, lexicon, syntax, orthography/phonology, knowledge of context, and the like. The knowledge sources are accessed by some sort of executive processor, given different names in different models, but all having the responsibility for selecting and controlling processing.

The executive samples information from these sources in parallel, although some models have more sequential constraints than others. The product of this sampling is a set of hypotheses about what the text says which are transferred to a central device to be examined by all contributing knowledge sources. Thus the outcome of reading, which is comprehension, is based on a consideration of multiple information sources, and the reader's hypotheses about meanings are monitored by all these knowledge sources. The necessity of consulting each of these sources of information, that is, phonology/orthography, syntax, context, knowledge of the world, lexical semantics, etc., in order to arrive at comprehensive interpretations of the text has been repeatedly confirmed in experimental programmes examining the effects of each, usually separately.

Finally, embedded in most, but not all such information-processing models of reading, is the notion of a limited capacity processor, sometimes called working memory. The executive is enslaved to working memory, having to achieve all its responsibilities within the space/time constraints imposed by process limitations. Reading presents a gruelling challenge to

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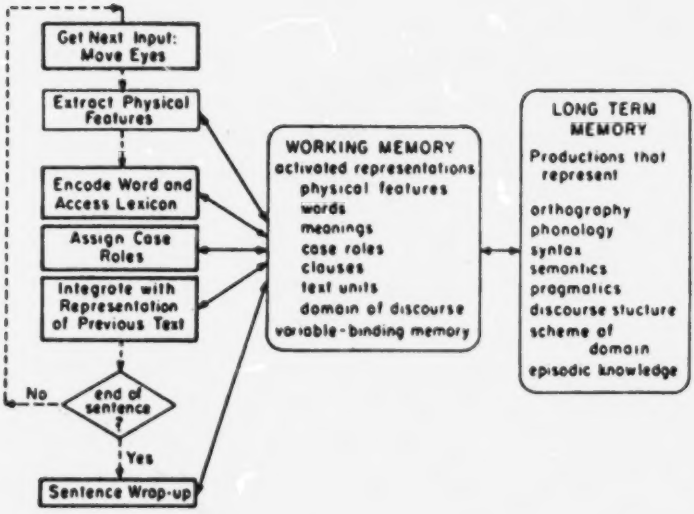
such limited-capacity processors, as constructing meanings requires holding in memory large stretches of information about preceding text, current visual information, and expected meanings, and integrating these all within real-time constraints. Indeed, some studies have shown that good and poor adult readers differ precisely on the extent to which their working memory is adequate to the task demands of reading.

An illustration of one model of reading which is fairly typical of this approach is that of Carpenter and Just (1981), shown in Figure 1. This model is particularly good because it is both well-elaborated (that is, there are relatively few fuzzy edges) and supported by substantial empirical data, most of which is based on an analysis of the reader's eye fixations while in the process of reading.

They describe reading as the "coordinated execution of a number of processing stages, such as word encoding, lexical access, assigning semantic roles, and relating the information in a given sentence to previous sentences and previous knowledge". The left-hand column shows the processing steps in some order which approximates the one used during most reading (Move eyes; extract physical features, encode word and access lexicon, assign case roles, integrate with representation of previous text, end of sentence? if no, then move eyes, extract physical features, etc.). The long-term memory on the right is the repository for all the relevant knowledge which will be sampled, and the working memory in the middle represents the actual operations as they

Figure 1

Model of Reading. From Carpenter and Just, 1981



occur. Following through their model gives a good overview of the subtasks that are implicated in reading.

Models of this type establish a framework for examining reading in which reading is construed as a complex information-processing activity. But these models necessarily offer descriptions at the level of skilled performance - the system functioning in its fully developed form. They tell us little about how children learn to read.

The most important feature of these models that must be pursued to arrive at a description of how children *learn* to read is the specification of the linguistic information that is invoked during reading. Important research in this area has substantiated the contribution of any number of such sources, as well as eluding to suggestions regarding the way in which it is represented. The developmental question is to examine how children arrive at the necessary level or type of linguistic representation and learn the necessary operations for surveying and interpreting this information as they learn to read. Accordingly, one must look carefully at the role of language in reading - how much language is necessary to read, and what form that knowledge of language must take.

Linguistic Knowledge and Reading

It is trivial to say that children need to know language in order to read. It is not trivial to ask what form their knowledge of language must take. Recent research into children's language development has addressed the development of what has

been called linguistic awareness, or, metalinguistic awareness. Children's concepts of language as a system, their explicit knowledge of the rules and properties of the language, and their ability to manipulate that system in formal and arbitrary ways, emerges at about the time they learn to read. Preschool children have great difficulty solving problems of the following type: counting the number of words in sentences, making formal judgments about the grammaticality of utterances and being able to provide appropriate corrections for deviant sentences, substituting words in given sentence frames, and selecting target words to match a stimulus on a property such as rhyme or alliteration. Strong hypotheses, sometimes leading to fierce debate, have been proposed to account for the temporal correspondence between these metalinguistic accomplishments and learning to read. Most of the evidence obtained is correlational, allowing three interpretations, all of which have been offered: linguistic awareness is prerequisite to reading, linguistic awareness is a consequence of reading, or both are byproducts of some third, but hidden, development. Aside from some interesting advances in certain aspects of linguistic awareness, for example, the case made by Bryant and his colleagues (Bryant & Goswami, 1987; Bradley & Bryant, 1983) for phonological awareness being causal to reading, the issue of causality is largely undecided. Indeed, even Bryant and Braddley allow within their strong arguments for the causal role of phonological awareness that reading, too, undoubtedly accelerates

phonological awareness as well. What is not controversial, however, is that reading involves some notion of language which is more highly specified, more explicit, than the conceptions of language that seemed adequate to oral conversation. So without entering the causal debate, it can be claimed that children's knowledge of language must be somehow more "metalinguistic" than it had previously been in order for them to become skilled readers.

What would it mean for knowledge of language to be more metalinguistic? The term metalinguistic is used extensively, but usually without much attention to defining the conditions that would serve to identify metalinguistic language from ordinary knowledge of language. I have argued elsewhere that there is probably little advantage in assuming that there is a distinct and discontinuous form of linguistic knowledge that carries higher levels of awareness, and little evidence to support such dichotomous interpretations. Rather, it seems more plausible, and more consistent with the developmental data, that children's knowledge of language undergoes constant and continuous change.

One aspect of this change is obviously quantitative - older children know more language than younger children, but aside from helping to read more difficult texts, this quantitative change is probably a trivial factor in determining reading ability. The other aspect of change is qualitative. The representation of children's knowledge of language changes. Mental representations are structured descriptions of knowledge, but for most purposes

the structure of the knowledge and accordingly, the structure of its representation, is unnecessary. We know if a sentence is grammatical without examining the details of its syntax. Indeed, linguistics have not yet told us what the correct syntactic description is. We convey meanings in ordinary conversation without examining the semantic networks of our chosen lexical items, nor being able to label the tense and aspect of the verbs we use. We translate sound sequences into words and sentences without having any theory about the relation between phonemes, words, and meanings. But to derive meanings from printed text, all those aspects of language that were implicit in ordinary conversation need to be made explicit so that they can be intentionally addressed and examined. Reading requires more explicit knowledge of language than does conversation, but it is an explicit knowledge of the *same* linguistic system that was used for conversation. This explication of the child's knowledge of language into structured organized categories for which formal structure becomes a feature of the representation has been described as a seminal aspect of children's language acquisition by such researchers as Bowerman (1982), Menyuk (1984), and Karmiloff-Smith (1986), and corresponds to what I have elsewhere referred to as the level of the child's analysis of linguistic knowledge.

Turning back to the information-processing model of Carpenter and Just described earlier, it can be seen that an analysed conception of language is fundamental to its operation.

Controlled access to such features of language as orthography, phonology, and syntax requires a fairly explicit knowledge of what a word is, how it is structured, and how it corresponds to written symbols. But the model also assumes a particular way of operating upon this knowledge, upon these analysed representations, that again is different from that which is perhaps used in ordinary conversation.

In conversation, the speaker and listener must focus their attention on meaning and carry out the linguistic processing within real-time constraints. This proves not to be difficult. We seem to be programmed to treat language at the level of meanings, and in fact, some theories of language acquisition, such as that proposed by Macnamara (1982), trade heavily on that fact and claim that it is the child's prior concern with meanings and knowledge of meanings that permits language learning to occur at all. So thinking about meanings is not a problem. Further, for adult fluent speakers of a language, the demand for automaticity is not problematic, as the challenge for fluency is easily met.

The operation of such processing, however, should not be taken for granted. Adults may gain some appreciation of the usual ease with which this process is executed in situations in which retrieval is temporarily disrupted, as for example in speech errors or tip-of-the tongue phenomena. Our main experience with processing difficulties in conversational speech is perhaps in speaking a second language - responses require time

to formulate, words are not always available on demand, structures do not emerge naturally. Yet, even in these cases of difficulty, we are single-mindedly focussed on meanings.

Children learning to read have to deal with a much more difficult barrier to processing. Reading requires paying attention to a number of sources of linguistic information, not only meanings. Visual information about graphemes, syntactic information about parts of speech, and contextual information about the emerging discourse must be juggled to arrive at an interpretation for the current text. This is a problem of controlling attention to select appropriate information, integrating that information, and holding all of this in memory to arrive at the meaning of the text. Put another way, the simple dotted line that connects the series of steps on the left side of the Carpenter and Just model translates into a major cognitive problem for children. Children's ability to select information, especially under distracting conditions, and to integrate that information to form responses, has been discussed as an aspect of cognitive development by such researchers as Donaldson (1978), Siegler (1978), and Case (1985). The application of that ability to reading is in the proper selection of information from the right-hand column of the model, and the integration of that information in the service of constructing meanings. This is the aspect of language use that I have previously referred to as control of linguistic processing. Reading, then, is a problem in language use that is solved at

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moderately high levels of development of analysis of knowledge and control of processing, as shown in Figure 2. This diagram illustrates how the intersection of specific values of analysis and control, when considered as Cartesian dimensions, can define the major domains of language use. As mastery of these skills continues, more difficult uses of language become possible.

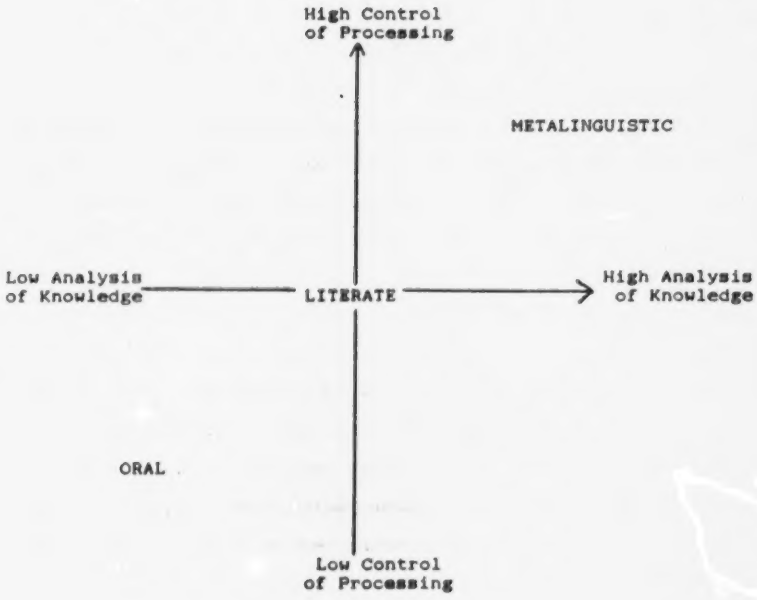
The Role of Analysis and Control

The conception of reading which follows from this view is that children learning to read require adequate levels of explicit, or analysed conceptions of language, and sufficient control over processing to select and integrate the necessary information. Fluent reading requires both these components. The difficulties experienced by poor readers can often be traced directly to these underlying processes. Regarding analysis, for example, poor readers have difficulty decoding new words, presumably because they lack analysed knowledge of phoneme/grapheme correspondences, word patterns, and the like. Similarly, poor readers have difficulty identifying important information, supplying missing words, as in a cloze test, and articulating rules. All these activities depend upon the relevant knowledge of language being represented in an explicitly structured form.

But analysis alone is not sufficient. A study by Scardamalia and Paris (1985), for example, aimed at improving children's writing by giving them explicit, presumably well-analysed knowledge of discourse rules. Intensive training

Figure 2

Domains of Language Use



sessions were followed by a post-test of free writing. Although the trained group used far more discourse connectors than did the untrained group, their texts were no more coherent. The trained students had plenty of analysed knowledge of discourse structure, but no control guiding their use of this knowledge to produce coherent text.

The same is true for reading. Control of processing is necessary to direct the selection and use of the necessary information. To this end, poor readers have difficulty in monitoring comprehension, integrating information over large stretches of text, and shifting the style or reading strategy to accommodate different purposes, such as reading for gist, reading for specific information, and the like.

The way in which these underlying skill components, analysis of linguistic knowledge and control of linguistic processing are involved in reading, has been examined in our ongoing research programme. The research paradigm is to develop tasks that measure analysis or control in relative isolation from each other and then to relate these measures to reading. To this end, I will describe two of the tasks we have used.

First is the Grammaticality Judgment test which consists of sets of sentences for which subjects must judge the syntactic acceptability. Each sentence could contain a grammatical error ("Why the dog is barking so loudly?"), a semantic error ("Why is the cat barking so loudly?"), neither ("Why is the dog barking so loudly?"), or both ("Why the cat is barking so loudly?"). These

Table 1

Grammaticality Judgment Task

Condition	Sentence	Task Analysis
Grammatical/Meaningful		
CM	Why is the dog barking so loudly?	(-A-C)
Ungrammatical/Meaningful		
gM	Why the dog is barking so loudly?	(+A-C)
Grammatical/Anomalous		
Gm	Why is the cat barking so loudly?	(-A+C)
Ungrammatical/Anomalous		
gm	Why the cat is barking so loudly?	(-A-C)

Note: -A indicates low levels for analysis
+A indicates high levels for analysis
-C indicates low levels for control
+C indicates high level for control

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items are illustrated in Table 1. Through a series of examples,the child is instructed to tell only if the sentence is said the right way or the wrong way, even if it is a silly thing to say. Detecting ungrammatical sentences has been shown to be more difficult than detecting grammatical ones (Bialystok, 1979, 1986; Hakes, 1980; Ryan & Ledger, 1984) because of the greater need for explicit knowledge of structure to identify errors as opposed to accept sentences that seem intuitively to be correct. Moreover, the judgment of form should be more difficult to carry out for anomalous sentences since greater attentional resources are required to ignore such salient errors in meaning. Anomalous sentences, therefore, require greater control of processing than do meaningful ones, since the meaning of the anomalous sentences must be deliberately suppressed in order to make a judgment about the form. Errors in grammar, conversely, must not be suppressed but rather attended to in order to arrive at the correct response. The four types of sentences, then, each make different demands on analysis and control:

GM. Grammatical,Meaningful. (-A-C)

gM. Ungrammatical,Meaningful. (+A-C)

Gm. Grammatical,Anomalous. (-A+C)

gm. Ungrammatical,Anomalous. (-A-C)

The most relevant items are the middle two because they provide the purest measures for one of the skills in isolation of the other. The gM is the analysis item and Gm is the control item.

The second task is the Form-meaning Judgment test. Children are asked to select which of two words corresponds to a given word in either its phonological form or its meaning. Each incorrect option always satisfies the opposite question. Thus, for each item, the options represent a form match and a meaning match to the target word, and the child is asked for one of these. Understanding the formal or semantic properties of the words in order to select the appropriate match indicates analysis of knowledge; attending to those properties under increasingly distracting conditions indicates control of processing. The question is asked in three conditions:

NC. **No context.** (+A-C)

SC. **Supporting context.** (-A-C)

AC. **Antagonistic context.** (-A+C)

These conditions are illustrated in Table 2. In addition to these experimental items, the test contains a set of neutral items in which the child is simply asked to make a form match or a meaning match, with no context provided, and no distraction created by the alternative choice. Again, the task is presented orally, so no reading is involved.

The results of this study, and others like it, show a role for both the child's level of analysis of linguistic knowledge and control of linguistic processing and a strict order for their relative importance. An example of the design used in these studies is shown in Table 3. By entering the data into a series of fixed-order multiple regression analyses, in which a

Table 2

Form-Meaning Selection Task

Condition	Context	Question	Task Analysis
No Context:			
NC	The leaves fell softly to the ground	What word sounds something like cat? hat or kitten?	(+A-C)
	The leaves fell softly to the ground	What word means something like cat? hat or kitten?	
Supporting Context:			
SC	The fat rat spat at the bat	What word sounds something like cat? hat or kitten?	(-A-C)
	The cats played happily with the ball of string	What word means something like cat? hat or kitten?	
Antagonistic Context:			
AC	The cats played happily with the ball of string	What word sounds something like cat? hat or kitten?	(+A+C)
	The fat rat spat at the bat	What word means something like cat? hat or kitten	

Table 3

Study of metalinguistic components of reading

Subjects: 159 children

Mean age = 8.11 years

Tasks:

Dependent Variable:

1. Gates-Macginitie Reading Test - Comprehension Subtest. Standardized test of reading level. Comprehension test consists of short prose passages followed by multiple choice questions.

Independent Variables:

1. Intelligence
   a. Block Design (Subtest of WISC-R)
   b. Backward Digit Span (Subtest of WISC-R)

2. Metalinguistic tasks
   a. Grammaticality Judgment
   b. Form-Meaning Selection

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standardized reading score was the dependent variable, it was shown that the bulk of the variance in reading level is attributable to the child's level of analysis of linguistic knowledge. One set of results for such an analysis is presented in Table 4. In terms of the present tasks, the child's ability to solve problems like judging ungrammatical sentences, and providing a match for a word in the neutral context conditions, predicts reading level. The child's level of control is relevant, that is, the ability to solve problems like judging anomalous sentences and selecting a match under distracting conditions, but only after sufficient levels of analysis have been assured.

Difficulties of Poor Readers

What happens for children who experience difficulty in learning to read, or who fail entirely to make much progress with the task? Some children suffer complex deficits that are not only linguistic but cognitive as well, and for these children reading is indeed an onerous task. But some children apparently show no specific linguistic deficit, are not dyslexic by any of the standard criteria, yet struggle terribly and remain several years below grade averages in learning to read. Moreover, it is the case that these children appear to display different profiles of reading difficulty - their problems are not identical. How can this analysis help to interpret the difficulties some children experience in learning to read?

One distinction between different kinds of poor readers has

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Table 4

(a)Regression of Gates MacGinitie on intelligence and metalinguistic variables

					Model	
Factor	Task	Demands	R Square	Rsq Change	F	p
Intelligence	Block Digit		.117	.117	12.38	.0001
Analysis	Judge gM Form-mng NC	+A-C +A-C	.266	.149	9.13	.0001
Control	Judge Gm Form-mng AC	-A+C -A+C	.276	.010	6.56	.0001
Baseline	Judge gm Form-mng SC Judge GM	-A-C -A-C -A-C	.381	.105	5.79	.0001

(b)Regression of Gates MacGinitie Entering Control before Analysis

Intelligence	Block Digit		.117	117	12.38	.0001
Control	Judge Gm Form-mng AC	-A+C -A+C	.193	.076	8.21	.0001
Analysis	Judge gM Form-mng NC	+A-C +A-C	.276	.083	6.56	.0001

been proposed by Baron (1979), who divided these children into two kinds. Phoenicians (later called recoders) are children who are orthographically sensitive to the sound-letter combinations on the page. They apply these skills consistently, and consequently have little difficulty reading regular words, although irregular words are extremely difficult. They can read nonwords because these procedures always produce some regular phonetic decoding of the text. It is, incidentally, a matter of some controversy whether or not reading nonwords is a relevant measure of reading. Given the interactive framework for reading models being assumed here, nonwords should clearly be excluded as they obviate the possibility of using contextual and general knowledge constraints for their interpretation. Nonetheless, the metalinguistic task of reading nonwords remains a valid instrument for describing one aspect of children's reading, namely, letter-sound decoding. Phoenicians, then, plod through the text sounding out words, but rarely arrive at a coherent interpretation of what they have read.

The other group is the Chinese, later called the whole-worders. These children look for configurations and holistic patterns in the words and attempt to read by sight. Accordingly, these children can read familiar words better than unfamiliar words, and obviously have no chance at all of reading nonsense words. These profiles are summarized in Table 5. Although it may appear that each of these groups is the product of one of the early dogmatic approaches to reading instruction, namely the

Table 5

Study of Metalinguistic Skills of Poor Readers

Subjects: 60 children, 9 years old -->

20 Good (average) readers

20 Recoder poor readers

20 Whole word poor readers

Recoders: "Phoenicians" (Baron, 1979)

-orthographically sensitive

-read regular words better than irregular

-can read nonwords (often produce nonwords as errors)

Whole worders: "Chinese"

-look for configurations and holistic patterns

-read familiar words better than unfamiliar

-cannot read nonwords (errors are other words)

Tasks: Grammaticality Judgment

Form-Meaning Selection

Phoenicians falling out of phonics and the Chinese falling out of look-say, there is in fact no systematicity in the methodologies by which these children were taught to read. In fact, the point should be stressed that neither of these reading strategies, that is, Phoenician or Chinese, is in any sense deviant. Good readers use both, some even preferring one to the other. The point about these poor readers is that they are incapable of incorporating the other strategy into their repertoire, and their reading level is curtailed by its absence.

The interpretation of the problem experienced by these groups of readers which follows from the conception of reading involving analysis and control is that the Phoenicians have adequate levels of analysis, demonstrated by their ability to segment, decode, and the like, but lack the control to integrate the products of decoding (hence the words can be read but not assigned meaning) and to incorporate other kinds of information, for example, visual and contextual, into the problem of constructing meanings. The Chinese, however, clearly lack the skills of analysis that allow them to enter the text, and are left to rely on a weak set of holistic correspondences that have been learned.

Our research with these readers has proceeded along just these lines. By using the same measures for analysis and control described in the previous study, we have shown that the recoders (Phoenicians) perform at the same level as age-matched good readers for tests of analysis, that is, detecting ungrammatical

sentences, but at a much lower level for tests of control, that is, judging anomalous sentences. Conversely, the whole worders (Chinese), perform at a consistently lower level than the good readers on both tests. On these measures, there were no differences between the whole worders and the recoders. These results are summarized in Table 6. Our interpretation, then, is that these two underlying linguistic skills are not only implicated in reading, but can be attributed with the responsibility for certain reading failures. Notice that even though analysis of linguistic knowledge was shown to be primary in the regression study, deficits in control even in the presence of sufficient levels of analysis, as was the case with the recoders in the present study, are disastrous.

Application to Reading and Reading-related Activities

An interactive view of this type is the basis for a large programme of research carried on by Ann Brown and her colleagues (Brown, Bransford, Ferrara & Campione, 1983). Their work is based on an integrative model that encompasses not only reading but the use of language in a variety of learning activities. Their model, which they call a "tetrahedral framework" places learning in the context of the four joint considerations of characteristics of the learner, the learning activities (in this case, reading), the nature of the materials, and the criterion tasks, usually comprehension.

On this model, reading is an active activity in which the reader interacts with texts, using a repertoire of cognitive

Table 6

Grammaticality Judgment Scores for Poor Readers

Group	Judgment			
	GM (-A-C)	gM (+A-C)	Gm (-A+C)	gm (-A-C)
Good readers	5.83*	3.94*	5.22*	3.92*
Recoders	5.73*	3.68*	4.10*	4.15*
Whole worders	5.65*	2.40	3.40	3.20
	G=R=W	G=R>W	G>R=W	G=R>W

*Scores differ from chance

Form-Meaning Selection Scores for Poor Readers

Group	Context		
	No Context (+A-C)	Supporting (-A-C)	Antagonistic (-A+C)
Good readers	1.49	1.59	1.58
Recoders	1.29	1.36	1.07
Whole worders	1.19	1.30	1.05
	G>W	G=R=W	G>R=W

strategies, to construct meanings and solve problems. Children who are more successful at reading are more successful at using a variety of strategies effectively. These strategies include the following:

1. clarifying the purpose of reading
2. identifying the important aspects of the message
3. focusing attention on major aspects not trivia
4. monitoring comprehension
5. taking corrective action if failure occurs.

By using these strategies, good readers are those who can adjust their style to suit the purposes of the task, take notes effectively, study profitably.

The basis of the strategies in the Brown *et al.* framework is a distinction between what they call the child's knowledge about cognition and the child's control over those cognition. This is not unlike the distinction between analysis and control in our own work, and in fact the five reading strategies can be interpreted roughly in those terms. The first two are governed by the child's level of analysis, the next two by the child's level of control, and the last, by an interaction between the two.

Identifying these or similar components as fundamental to reading leads inevitably to the question of instruction and remediation. If these (or similar) strategies are basic to skilled reading, can they be taught to children who have not arrived at them spontaneously? Intervention research of this

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type by Brown and her colleagues has met with extremely limited success. Children can be taught the strategies, and can be given practice in their execution, but the performance benefit on reading level, learning potential, and study effectiveness, it appears, accrues only if the child understands the strategies and applies them spontaneously and intentionally to new situations. Again, straightforward pedagogical methods are undermined by the enormous complexity of reading.

The Relation Between Language and Reading

What does this view tell us about language, language acquisition, and reading? There are, it appears, two conclusions, neither of which provides any answers, but rather give direction to future research and theorising.

First, the initial assumption that reading must be described within a complex cognitive system has been confirmed. Whether or not the specific proposals for a model of reading that have been offered here are accepted, the evidence nonetheless commits one to a model that incorporates both notions of representation and notions of processing in sufficient detail to account for behaviour. Restricted models of reading that place all the explanatory burden on one simple component, whether it is recognition, contextual interpretation, or decoding, are clearly obsolete.

Second, the theory of language representation and language acquisition which is consistent with these claims carries special features as well. If there is a new emphasis in psychology and

psycholinguistics, it is a concern for representation. In fact, distinguishing representational systems from processes or operations on those representations has led to important advances in cognitive psychology. The models of reading I have been describing are all of this type: the child's knowledge of language is considered apart from the processes that reading demands be applied to those representations.

The stumbling block in all the models, however, is the lack of a detailed and convincing description of how linguistic knowledge is represented. This is the gap that must be addressed. Some constraints on what a useful and reliable description would look like can be offered. The representation, for example, must accommodate a variety of linguistic information: semantic relations, orthographic/phonemic correspondences, syntactic structures, pragmatic forces, and the like. Moreover, these features must be interlinked in complex ways so that each is available when necessary and all are accessible through any form of stimulus input. Finally, and perhaps most important, these representations must be dynamic. Part of development is the development of representations. There is ample evidence that children not only become better performers, but also does the form of their knowledge change. The kind of change I have suggested here is towards representations that are more explicit as the result of greater analysis of those representations. The endpoint of such analysis is representations that can be articulated. In this sense, the

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highest form of mastery of a domain of knowledge is to be able to articulate the system.

Some have argued that this is counterintuitive, arguing, for example, that as we become better tennis players we become less able to describe the skill. But this is fallacious for the same reason that the common (but incorrect) belief that younger children are better language learners than older children is fallacious. Younger children have less to learn and more time to do it in, so the illusion is one of greater achievement. Saying a few coherent sentences satisfies the onlooker that the child is bilingual. The same is true for the tennis player. The novice, knowing only one or two principles of the game, has no difficulty listing those rules. The real insight and the rich description can only come from the master, and only then, when the player engages in the deliberate and careful analysis of the implicit knowledge that has accrued and guides their play. Explicit articulated knowledge is the highest level of achievement in a cognitive domain.

So returning to the problem of describing linguistic knowledge, what kind of system can be proposed that satisfies these criteria? Chomsky (e.g., 1980) is one of the few linguists who professes a real concern for representation. His interest, in fact, is perhaps too limited in the sense that he shows little regard for performance and believes that only a description of competence, which essentially is representation, is necessary. But the main problem with his view in the standard form is that

it does not allow for those representations to change in the ways described here - there is no development nor even the possibility of development. All these kinds of changes are relegated to performance and therefore rendered uninteresting. Yet we need a linguistic theory that will set the framework for the types of processes we have observed and empirically demonstrated with children learning to read. Real progress on these issues awaits such a theory.

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